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Notes on the American Species of Marsilia.

By L. M. Underwood and O. F. Cook.

The accumulation of a large amount of material in public and private herbaria permits a clearer view of the relations of the American species of this genus, and the need of a thorough revision is apparent. While the status of some of our species will depend upon the light given by further collections and the observation of growing forms, it is thought desirable to place on record the results of a preliminary study of the specimens in the two herbaria most extensively consulted. Free access to the collections at Cambridge and at Columbia College has made this study possible, and grateful acknowledgment is here rendered.

The first species of *Marsilia* discovered in America were *M. vestita* and *M. polycarpa*, described by Hooker and Greville in 1831. A. Braun described a third species, *M. uncinata*, in 1839, and a fourth, *M. mucronata*, in Silliman's Journal in 1847. Two other species were described in the same year by Dr. Engelmann, viz., *M. tenuifolia* and *M. macropoda*. In 1857 Feé described *M. picta* from Mexico, and in 1860 Dr. T. F. Allen discovered the European *M. quadrifolia* in Connecticut. *M. Mexicana* was described by A. Braun in 1870, making in all nine nominal species. These comprise all the forms represented in the two herbaria named. Two other species were described by Braun from the West Indies, but so far as we know they are not represented by specimens in any American collection, if indeed they represent valid species. Since 1870 many forms have been collected, notably in the Northwest and Southwest, so that some of the species are represented by very extensive suites.

SYNOPSIS OF SPECIES.

A.—Sporocarps numerous, attached to the stipes in a row by short horizontal peduncles - - - *M. polycarpa.*
Sporocarps on erect or ascending peduncles, arising from the base of the stipe - - - - - - - - - *B.*
B.—Sporocarps 2-6 on each peduncle - - - - - - - - *C.*
Sporocarps 1 (rarely 2) on each peduncle - - - - *D.*
C.—Plant robust, hairy; sporocarps 2-6; sori, 10 in each valve - - - - - - - - - - *M. macropoda.*
Plant more slender, smooth; sporocarps 2-3; sori, 8-9 in each valve - - - - - - - - *M. quadrifolia.*
D.—Peduncles 2-4 times the length of the sporocarps; sori, 13-14 in each valve - - - - - *M. uncinata.*
Peduncles shorter, not more than twice the length of the sporocarps; sori, 6-11 in each valve - *M. vestita.*

1.—*M. polycarpa*, Hooker et Greville, Icones Filicum, II., tab. 160 (1831); A. Braun, Monatsberichte der Königl. Akad. der Wissens. zu Berlin, 1863, 417; ibid, 1870, 772.

HAB.—Cuba (Wright, Nos. 1799 and 1800); Jamaica (Arnott)†; Guiana (Arnott)† plant very large; Brazil (Burchell, No. 9488 *, Blanchet †).

2.—*M. quadrifolia*, Linnæus, Species Plantarum, Ed. I; Gray's Manual, 5th Ed., 678; Underwood, Our Native Ferns and their Allies, 115.

M. quadrifoliata, Linn., Sp. Plant., Ed. II.; A. Braun, Monatsb., 1863, 418; 1870, 724; 1872, 658.

Plant usually slender, 5-12 cm. high; leaflets variable, 4-14 mm. wide, 5-15 mm. long, margins entire, smooth, or rarely with scattered hairs when young; sporocarps 2 (rarely 3), on a branching peduncle, which is usually attached to the stipe near its base, but sometimes as much as 2 cm. above; young sporocarp with short yellowish-brown hairs, later becoming naked and dark purple; lower tooth obtuse, upper small, acute or obtuse; sori, 8 or 9 in each valve.

HAB.—Bantam Lake, Litchfield Co., Conn., (Dr. T. F. Allen, 1861), from whence it has been cultivated in several localities; Europe; Asia.

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* † References marked with a * are found in the Gray Herbarium; those marked with a † are in the Columbia College Herbarium; those unmarked are in both.

3.—*M. macropoda*, Engelmann, Amer. Journal Science, 2d Series, III., 56, (1847); Underwood, Our Native Ferns and their Allies, 115.

M. macropus, A. Braun, Monatsb., 1863, 418; 1870, 726; 1872, 660.

Plant robust, 10-25 cm. high; leaflets large, 2-5 cm. long, 2 cm. wide or less, usually undulate, clothed with white hairs on both sides when young, becoming smoother with age; sporocarps 2-6, on erect branching peduncles, ascending, densely villose, 6-8 mm. long, 5-6 mm. wide; raphe short, the lower tooth obtuse, the upper inconspicuous or wanting; sori, 10 in each valve.

HAB.—Texas, Rio Grande (Wright, 1848)*, Guadaloupe Co. (Lincecum)*, Ponds on the Seco (Reverchon)†, Austin (Buckley)†, Western Texas (Wright, No. 812)*; New Mexico (Wright, No. 2111).

4.—*M. uncinata*, A. Braun, Flora, 1839, 300; Amer. Jour. Science, 2d Series, III., 55; Monatsb., 1863, 423; 1870, 742; 1872, 665; Chapman, Flora of Southern States, 672; Gray, Manual, 678; Underwood, Our Native Ferns and their Allies, 115.

Plant 6-20 cm. high; leaflets nearly smooth, entire, 10-16 mm. long; sporocarps 6 mm. wide, 8 mm. long; peduncles 15-30 mm. long; raphe long, terminating in two approximate teeth, the upper longer and mostly uncinately curved; sori, 13-14 in each valve.

HAB.—Western Louisiana (Hale); Dallas, Texas (Reverchon, in Curtiss' N. A. Plants, No. 3819).

5.—*M. vestita*, Hooker et Greville, Icones Filicum, II., tab. 159, (1831); Engelmann, Amer. Jour. Science, 2d Series, III., 55; A. Braun, Monatsb., 1863, 424; 1870; 741; 1872, 662; Watson, Botany of California, II., 351; Underwood, Our Native Ferns and their Allies, 115; Coulter, Manual, 437.

M. villosa, Brackenridge, Ferns of U. S. Explor. Exped., 340 (Amer. plant only ?).

M. mucronata, A. Braun, Amer. Jour. Science, 2d Series, III., 55, (1847); Monatsb., 1863, 423; 1870, 740; Underwood, l. c., 115,

M. picta, Feé, Cat. des Foug. du Mexique, 47 (1857).

M. Holtingiana, Schaffner, in Herb. Gray.

M. minima, Fournier ex. Schaffner, in Herb. Underwood.

Plant 3-6 cm. high; leaflets entire or slightly toothed; sporocarps 4-7 mm. long, 3-5 mm. wide; raphe short, lower tooth short and blunt, the upper acute, a little longer, sometimes curved; paleæ varying from soft, dense and spreading to short and appressed, in *mucronata* forms, where it is sometimes wanting; sori, 6-11 in each valve; a very variable species.

HAB.—California (Wilkes' Expl. Exped., 1838-1842)*, Sierra Co. (Lemmon, 1874), San Diego (Orcutt, 1884)*; Nevada, Goose Creek Valley (Watson, 1868, Expl. 40th Par., No. 1372); Oregon (Wilkes' Expl. Exped., 1838-1839)*, (Hall, 1871, No. 697), Multonomah Co. (Howell, 1877)*, (Geyer, No. 450); Washington Ter., Columbia River Valley (Northern Transcont. Survey, No. 1225; Watson, 1880)*, Klikatat Co. (Suksdorf, 1878, 1883)*, Falcon Valley (Suksdorf, 1883, No. 227)*; (Hall and Harbour, 1862, No. 254)*; Montana, Big Blackfoot Valley (Watson, 1880)*; Dakota, Stark Co. (Seiberg, 1884)*; Devil's Lake (Nicollet, 1839)†; Kansas, Ellis (Watson, 1874)*, (E. N., Plank, 1884)*; Arkansas (Nuttall)†; Texas (Lindheimer, 1847, No. 746)*, between Cibols and upper Guadaloupe (Lindheimer, 1847, No. 404)*, Comanche Spring (Lindheimer, 1849)*, Western Texas (Wright, 1849, No. 811), (Drummond, 1870, Ex. Herb. Gay), Dallas (Hall, 1872, No. 861)*, Austin (Hall, 1872, No. 860)*, Dallas (Reverchon, in Curtiss' N. A. Plants, No. 3821); New Mexico (Wright, 1851, No. 2112); Arizona, Stephens' Ranche (Lemmon, 1882, No. 2896); Mexico, San Louis Potosi (Schaffner, 1875-7, distributed as *M. Höltingiana*)*, (also as *M. minuta*, Fournier, in Herb. Underwood); Nicaragua (Wright, North Pacific Expl., Exped. 1856).

Var. TENUIFOLIA (*M. tenuifolia*, Engelmann, Amer. Jour. Science, 2d series, vi., 89, note (1848)*; A. Braun, Monatsb., 1863, 425; 1870, 740; 1872, 664; Underwood, l. c., 114).

Plant somewhat slender, 5-15 cm. high, leaflets narrow (2-4 mm. wide), more or less falcate, the apex often somewhat truncate and unequally toothed, villose with appressed hairs; sporocarps single, 5-8 mm. long, 4-5 mm. wide, the teeth divergent, subequal; sori, 9-11 in each valve.

HAB.—Texas (Wright), Pierdenales (Lindheimer, 1847, No. 745)*.

The above references include a wide range of characters, a few of which seem to call for special notice. Suksdorf's Falcon Valley specimens are by far the finest seen, the stipes being cinnamon-brown, while the paleæ of the sporocarps are long and silky; this form may be regarded as typical of the species. Orcutt's San Diego specimens are very large, approaching *M.*

macropoda in size and general habit. Drummond's Texan specimen is represented by two plants, of which the sterile has the habit of *M. macropoda* and may belong to that species, but the fertile plant is a true *mucronata* form of *M. vestita.* Sterile specimens collected by Lemmon in the Sierra Valley are aquatic, and nearly smooth throughout. Specimens from Kansas, collected by Watson and by E. N. Plank, are very much reduced, being even smaller than Wright's No. 2112, which Braun called var. *minima.*

The distinctions which formerly separated *M. mucronata* can be maintained no longer, since they are sometimes united in the same plants, e. g., on Nicollet's Devil's Lake specimen, which Dr. Torrey originally referred to *M. vestita,* but which Braun placed in *M. mucronata.* Specimens cultivated by Braun (coll. in Texas by E. Hall) and distributed to the Gray Herbarium as *M. uncinata,* do not agree in any particular with his own description of that species, but are certainly his *M. mucronata.*

Reverchon's Texas specimens, distributed as *M. mucronata,* show a tendency to vary toward var. *tenuifolia* in the narrower leaflets, suggesting the inconstancy of that variety.

M. picta, Feé, is an enormous floating form, curiously marked on the under side of the leaflets by radiating ferruginous lines, giving it a unique appearance. Its true relations must be determined by further observation.

In order that some important particulars upon which the classification depends may be more fully established, it is desirable that collectors should pay especial attention to the following points :

(1) In the same species note variations dependent upon station ; that is, whether growing in mud, in marshy ground, in somewhat dry soil, in flooded regions or purely aquatic. Judging from the great amount of variation already noted resulting from station and environment, it is certainly desirable to note the extent to which this variation is carried ; certain it is, that the hairiness of the sporocarp, which often varies with age, cannot distinguish one species from another, a principle that has not always been considered in descriptive works.

(2) Note specimens of *M. uncinata* in mature fruit and de-

termine the constancy of the characters by which it is separated from *mucronata* forms of *M. vestita.* These are (a) larger number of sori in each valve, (b) greater length of peduncles, (c) uncinate upper tooth of the sporocarp.

(3) Determine the degree of fixity of characters in var. *tenuifolia* of *M. vestita.* No specimens are known to exist except those of Lindheimer and Wright, collected in 1848, and these seem to characterize a well-marked variety. The existence of a somewhat intermediate type in Reverchon's specimens distributed as *M. mucronata*, and the fact that the original form has not been sent in by recent collectors, seem to throw doubt upon the constancy of its characters, as does also the consideration that all the other distinguishing features insensibly grade into *mucronata* forms of *M. vestita* ; hence, if it stands, it must stand on the basis of the narrow leaflets alone.

(4) Observe the relations and the cause of the markings on *M. picta*, Feé, from Mexico. It was claimed by the late Dr. Schaffner, who collected *Marsilia* at San Luis Potosi, that *M. picta* was the floating form of his *M. Höltingiana*, which we consider a depauperate form of *M. vestita.* Such a marked degree of variation would not seem to us impossible, as certain floating forms of *M. vestita* are as markedly in contrast with the usual forms of that species, if we except the " pictæ ; " and Dr. Schaffner claimed that these were produced by infusoria and larvæ. Indeed, we have observed natant forms of *M. quadrifolia* in Bantam Lake that would present a no less difficult problem to the species-maker, if he were to observe them as herbarium specimens instead of in the field.

New Grasses.

By George Vasey.

POA RUPESTRIS. Culms densely tufted, 6 to 9 inches high, erect and rigid, striate ; cauline leaves (2 or 3) very narrow, erect, 1 to 1½ inches long; ligule conspicuous, membranaceous; sheaths smooth, striate; upper part of culm naked; panicle ¾ to 1½ inches long, narrow, and sparsely flowered; branches short, single or in twos below, each with 3 to 5 spikelets, somewhat expanding in bloom; spikelets about three-flowered, 1½